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THESIS

A COMPARATIVE ANALYSIS OF THE HIGHER COSTS PER FLIGHT HOUR OBSERVED IN FORWARD DEPLOYED NAVY SQUADRONS

by

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A COMPARATIVE ANALYSIS OF THE HIGHER COSTS PER FLIGHT HOUR OBSERVED IN FORWARD DEPLOYED NAVY SQUADRONS

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ABSTRACT

This thesis is an in depth analysis of the higher costs per flight hour reported from Navy squadrons stationed in Japan. The purpose of the thesis is to identify, analyze and quantify the factors contributing to these higher costs. The study begins with a review of the current Navy funding and reporting systems, and a description of the basic costs of operating Navy aircraft. Then, a direct comparison of maintenance and repair costs is made between the squadrons of three Navy air wings. The analysis includes factors determined to play a major role in raising costs, as well as other minor factors that were uncovered during the research. The thesis concludes with a summary of findings and areas recommended for further study.

TABLE OF CONTENTS

I. INTRODUCTION

A. BACKGROUND

The United States Navy has maintained a forward deployed aircraft carrier in the western region of the Pacific Ocean since the later days of the Vietnam war. Since that time, both the aircraft carrier and her assigned air wing have been "homeported", or permanently assigned, to U. S. naval installations located in Japan. This agreement, of forward deploying an aircraft carrier in a foreign country, is particular to the Pacific theatre. The underlying reason for this arrangement stems from the vast expanse of the Pacific Ocean, when compared to the other major bodies of water in the world. Transit times for naval vessels, from the continental United States to areas of operation in the western Pacific and Indian Oceans, are four or more times greater than for their counterparts transiting to the North Atlantic Ocean or Mediterranean Sea. By maintaining a ready Carrier Battle Group in a forward deployed status, reaction time for any type of contingency operation in that area of the world is dramatically reduced.

The forward deployed aircraft carrier and her assigned air wing (currently the USS INDEPENDENCE and Carrier Air Wing FIVE) fall under the administrative command of Commander, Naval Air Forces, U. S. Pacific Fleet (COMNAVAIRPAC or CNAP). Acting in this capacity, CNAP is responsible for administering

the Navy Flying Hour Program (FHP) for all aviation assets in the Pacific Fleet. It is through this Flying Hour Program that budgets are formulated and aviation activities are funded to fly.

In these days of austere funding for defense programs, increasing emphasis is being placed on analysis of the financial and management control systems in place, in efforts to uncover areas where expenditures might be reduced. These efforts have been more than merely an attempt to locate possible areas of fraud, waste and abuse of appropriated funds. The current analyses are going much deeper, into the operational functions of the Navy, to determine if resources are allocated and consumed in the most efficient and effective manner. During such analysis, CNAP made a unusual discovery about the costs per flight hour of the forward deployed air wing, when compared with the five remaining air wings in the Pacific Fleet. Costs per flight hour for the forward deployed air wing ran consistently higher by a factor of approximately thirty percent. The general focus of this thesis is an examination of these cost per flight hour variances that result from the permanent assignment of a Carrier Air Wing to an overseas location.

B. OBJECTIVES AND SCOPE

The purpose of this thesis is to perform an in depth analysis of the factors that generate variances in the cost

per flight hour determination within the Flying Hour Program. An assessment of factors will be made to determine their application to the peculiar arrangement of operating a Carrier Air Wing from a foreign shore. The resulting factors will be quantified to measure their individual contribution to the overall variances that have previously been observed. For completeness, a listing will be included of the factors which are deemed too difficult, if not impossible, to accurately quantify. The financial impact of these cost variances on the management of the Flying Hour Program at the Type Command level will also be explored. Finally, conclusions and recommendations will be drawn from the research to help ensure the resources of the Flying Hour Program are allocated in the best interests of Naval Aviation, and the Navy as a whole.

The scope of this thesis is limited to the carrier-based tactical aviation squadrons under the cognizance of Commander, Naval Air Forces, U. S. Pacific Fleet. However, the implications from this research may be applicable to most of Naval Aviation, particularly carrier-based aircraft squadrons. To preserve the accuracy of research data, all cost comparisons will be made between the same type and model of aircraft, employed under similar operating conditions. The cost variations will be the difference between the actual costs per flight hour for individual air wings by aircraft Type/Model/Series (T/M/S), rather than the actual versus budgeted costs.

C. RESEARCH QUESTIONS

The following research questions are addressed in the body of the thesis:

1. What are the major factors that contribute to the experience of higher costs per flight hour for a forward deployed air wing?

2. To what degree do each of these factors contribute to the overall variance in costs?

3. What are the other possible factors, which are difficult if not impossible to quantify, that might also be contributing to the cost differences?

4. What is the fiscal impact that funding the forward deployed air wing at a higher level has on the remaining air wings in the Pacific Fleet?

D. METHODOLOGY

The data used for this thesis were obtained through professional materials from Navy commands, government publications, books, articles, previous theses, and interviews. Personal interviews were used extensively to supplement the limited materials published on the topics and issues. Interviewees included the COMNAVAIRPAC Comptroller, as well as both the operational and financial CNAP Flying Hour Program Managers. In addition, persons with previous experience in squadrons from Carrier Air Wing FIVE were interviewed to get the "Japan perspective." The research made heavy use of official Navy documentation, including historical cost data and flight hour records. The working papers from a

past study conducted at CNAP using information collected from Budget Operating Target Reports (BOR's) and Flight Hour Cost Reports (FHCR's) were used as a starting point for this research, and the basis for subsequent data collection.

E. ORGANIZATION

This thesis is divided into five chapters. Chapter I provides the introduction and purpose for this document. It states the research questions, the objectives to be accomplished, the scope of the analysis, the methodology to be employed, as well as the organization of the thesis.

Chapter II presents a detailed explanation of the Cost Per Flight Hour (CPH) determination at the type commander level. The inputs are described, as well as the various cost pools associated with operating Navy aircraft. The procedures and complications associated with funding the Flying Hour Program are introduced.

Chapter III describes the methodology employed in this study of Cost Per Flight Hour variances. The parameters used for comparison are presented, as well as the factors used to screen the data for inclusion.

Chapter IV provides an analysis of the research results and attempts to quantify the contribution of individual factors into the overall variance of flight hour costs. The impact of these cost differences on the management of the Flying Hour Program is examined.

Chapter V presents conclusions to address the research questions, along with any related problems uncovered during the research phase. Suggestions for further research and some additional remarks also are included.

II. COST PER FLIGHT HOUR

A. PURPOSE OF CHAPTER

The most significant variable used in the management of the Navy Flying Hour Program is the Cost Per Flight Hour (CPH). It is used extensively in preparing budgets, allocating funds, and tracking the efficiency of execution of the flight hour dollars. It is calculated using different methods at the various levels of management in the Flying Hour Program. This fact accounts for many of the problems encountered in tracking and reporting costs at different levels in the organization. This chapter will address the CPH at the type commander level, including the calculations employed at COMNAVAIRPAC. The cost pools associated with the CPH determination will be introduced, along with some of the peculiarities of data collection and submission. In addition, some funding background will be offered to facilitate later analysis of the effects of higher CPH rates on the remaining air wings.

B. DETERMINING COST PER FLIGHT HOUR

In simplest terms, CPH is the total cost of operating aircraft (fuel, parts, maintenance, etc.) divided by the total number of hours flown. However, the equation gets more complicated with the allocation of miscellaneous costs and the requirement of soliciting cost inputs from various sources.

1. Costs at the User Level

The financial obligations incurred by operational units in direct support of the Flying Hour Program fall under two primary budget lines, known as Operational Target Functional Categories (OFC's) [Ref. 1:Encl. (1), pp.1-2]:

- <u>OFC-01</u>: Primarily Aircraft Flight Operations (AFO); includes petroleum, oil, and lubricants (POL), as well as other support and maintenance material (e.g., aviator's flight equipment, administrative supplies, etc.). Also included are some minor AOM items. These costs are largely accounted for under the 7F (Fuel) and 7B (Administrative and Flight Equipment) funding codes, and are predominantly incurred at the squadron level.

- <u>OFC-50</u>: Primarily Aircraft Operations Maintenance (AOM); includes Aviation Fleet Maintenance (AFM) consumables and repairables (which includes both Organizational level (OMA) and Intermediate level (IMA) maintenance), Aviation Depot Level Repair (AVDLR), and Individual Material Readiness List (IMRL) item repair. This category also includes AOM performed while a unit is deployed away from its home station, where it is funded by an AFM OPTAR given to the tenant maintenance facility involved. These costs are largely accounted for under the 7L (AFM, Consumables) and 9S (AVDLR) funding codes, and are predominantly incurred by aviation-related ships and shore facilities.

Totals for each of these categories, separated into aircraft Type/Model/Series (T/M/S) and Type Equipment Code (TEC) whenever possible, are submitted to the Type Commander in the formats described in the next section.

2. Inputs to the Type Commander

CNAP receives the expense and costing information generated by each of the aviation-related units under its cognizance in two forms. Flight Hour Cost Reports (FHCR's)

are submitted by shore stations, while ships and squadron inputs are submitted through Budget Operating Target Reports (BOR's). These reports are used at the Type Commander level to [Ref. 2, p. 51]:

- Evaluate the unit (as well as the total Force) respective financial situation.
- Support subsequent fiscal year budget decisions and submissions.
- Measure ship/station/squadron budget performance.
- Prepare required FHP management control reports.

Not only do the Flight Hour Cost Reports and Budget OPTAR Reports update the Type Commander on the fiscal status of each reporting unit, they also serve as a check and balance for the individual ship/station/squadron to confirm its financial situation. This is to avoid the legal complications of overspending funds appropriated by Congress. [Ref. 3, p. 26]

Flight Hour Cost Reports are submitted monthly by shore facility comptrollers via Priority message. They contain all obligations incurred during the previous month, with totals listed as dollar amounts. They are the primary source of information on AVDLR and AFM costs for non-deployed squadrons. [Ref. 4, p. 31]

Budget OPTAR Reports are submitted on the same monthly schedule from both aviation-related ships and squadrons. The inputs from aircraft carriers contain information similar to the shore station FHCRs. It is the primary source of AVDLR

and AFM costs for squadrons in a deployed status. In addition, the BORs list the OPTAR remaining for comparison with budget records at CNAP.

The squadron BORs contain obligation totals for aircraft operations (AFO), along with AFM costs incurred at the Organizational level. They list information on the number of aircraft assigned, flight hours flown during the month, and a cumulative total of flight hours for the fiscal year. The type of fuel and total gallons consumed during the month are also included. [Ref. 5, p. 33]

Information from these reports is compiled by the Force Comptroller and distributed for both local management of the Flying Hour Program and to satisfy the TYCOM reporting requirements.

3. Cost Pools

The cost of operating Navy aircraft can be broken down into four basic cost pools: Fuel, OMA, IMA, and AVDLR.

- Fuel - The cost of aviation fuel, engine oil, and lubricants.
- OMA - Organizational Maintenance Activity; the costs incurred at the squadron level to maintain the aircraft. OMA costs are entirely for consumables, or items that are more economical to replace than to repair.
- IMA - Intermediate Maintenance Activity; the cost associated with intermediate level repair and maintenance. These are Aircraft Intermediate Maintenance Department (AIMD) costs and are related to both consumables and repairables.

- AVDLR - Aviation Depot Level Repair; the cost of major component rework, repair, and replacement beyond the capability level of AIMD. For most aircraft T/M/S, AVDLR represents the largest and most variable cost pool. [Ref. 4, p. 36]

From these four cost pools the total obligation for each aircraft can be calculated using the formula discussed in the following section.

4. Calculating the Cost Per Flight Hour

A six-step process is used to calculate the total Cost Per Flight Hour for each aircraft Type/Model/Series in the Pacific Fleet inventory. This process must be employed separately for each aircraft T/M/S, and can become quite tedious when the numbers are compiled manually. A simplified version of the process, using the F-14A as an example, is outlined in Figure 1.

First, all the costs from the 7L funding code which have been charged to that category of aircraft are collected from the Budget OPTAR Reports and Flight Hour Cost Reports. This number, from each reporting activity, is then divided by the total 7L non-miscellaneous costs for that activity to provide a ratio for allocating 7L miscellaneous costs. The aircraft T/M/S 7L costs are then combined with the allocated portion of 7L miscellaneous costs to provide the "Adjusted 7L Cost." This same formula for allocating miscellaneous costs is then applied to the costs from the 9S funding code, with the result being the "Adjusted 9S Cost."

CALCULATING AIRCRAFT CPH

Example: F-14A

7L = AFM, CONSUMABLES

9S = AVDLR

1. For each BOR from CV's, and FHCR from NAS's:

   $\frac{\text{F-14A 7L costs}}{\text{7L non misc costs}}$ X 7L misc costs = F-14A misc cost portion + F-14A 7L costs = **Adjusted F-14A 7L cost**

   $\frac{\text{F-14A 9S costs}}{\text{9S non misc costs}}$ X 9S misc costs = F-14A misc cost portion + F-14A 9S costs = **Adjusted F-14A 9S cost**

2. Add up all Adjusted F-14A 7L and 9S costs from each location = **Total Adjusted 7L/9S cost**

3. Add up all F-14A flight hours from squadron BORs = **Total F-14A Flight Hours**

4. Add up all F-14A 7F costs from squadron BORs = **Total F-14A 7F cost**

5. Add up all F-14A accounting adjustments from DAO = **Total Accounting Adjustments**

6. $\frac{\text{Total Adj 7L + Total Adj 9S + Total 7F + Total Acct Adj}}{\text{Total F-14A Flight Hours}}$ = **F-14A COST PER FLIGHT HOUR**

Figure 1. How T/M/S Costs Per Flight Hour are calculated.

The second step is to combine the Adjusted 7L and 9S Costs from each location to get the "Total Adjusted 7L and 9S Costs" for that particular aircraft. The third and fourth steps of the process involve acquiring and totalling information from the individual squadron BORs. The total flight hours for each aircraft T/M/S are provided in those documents, as are the 7F (Fuel) costs from each squadron. The fifth step in the process is to find and compile all the accounting adjustments for that aircraft, issued from the Defense Accounting Office (DAO).

When all the costs have been captured using the preceding steps, the sixth and final step in calculating the CPH is simply to divide the costs by the total number of hours flown. For analysis purposes, the Cost Per Flight Hour can be figured for each of the funding codes individually (7F, 7L, and 9S), as well as for the total CPH of that aircraft. [Ref. 6]

What this procedure is unable to determine is the total CPH of a particular squadron flying that category of aircraft. If information on individual squadron CPH was easily calculated, then a direct comparison of Japan-based squadrons with the CONUS-based squadrons could be easily accomplished. For this reason, COMNAVAIRPAC has expressed interest in a study of this nature.

C. FUNDING THE FLYING HOUR PROGRAM

At all levels in the funding chain for the Flying Hour Program, from Congress down through the Type Commander, the emphasis is on achieving a specific level of readiness. The substitute measure used to estimate this level of readiness is referred to as Primary Mission Readiness (PMR). PMR is actually a number that represents the amount of flight hours required to ensure that all flight crews are proficient in their respective Primary Mission Areas (PMA). But, for funding purposes, PMR is usually referred to as a percentage of that flight hour requirement. For example, if a squadron were funded to be fully proficient in all their assigned PMAs,

they would be funded at 100% PMR. Unfortunately, this is rarely the case. In fact, Congress and the budgeteers at NAVCOMPT have historically funded the Flying Hour Program in the region of 85-87% PMR [Ref. 7].

The fact that Naval Aviation is not initially funded at 100% PMR places additional pressure on the TYCOMs and other Flying Hour Program managers to make up the difference. The process that CNAP has traditionally used to compensate for this shortfall is to fund squadrons according to their activity level. The activity level is determined by the where a squadron is in its "turn-around cycle."

Deployments and turn-around cycles will be discussed in more detail in the next chapter. For the purposes of this discussion, the turn-around cycle is simply the eighteen month period used for scheduling aircraft carrier deployments, along with all the requisite aircraft and air wing training in preparation for those deployments. Because the flight hour requirements vary for each stage of the turn-around cycle, air wings homeported in the continental United States (CONUS) are typically funded on a scale similar to the following [Ref. 4, p. 47]:

- Month 1: Personnel turnover and leave 25% PMR
- Months 2-9: Turn-around training 78% PMR
- Months 10-12: Pre-deployment training 105% PMR
- Months 13-18: Forward deployment period 125% PMR

For the forward deployed air wing, readiness requirements dictate that funding is at or above 100% PMR for the majority of the turn-around cycle [Ref. 7]. This is due not only to their unique mission of maintaining a forward presence, but also the close proximity of potentially hostile nations. The implications of funding the forward deployed air wing at a higher level will be addressed in Chapter IV.

III. DATA FOR COMPARISON

A. BASICS OF THIS STUDY

This chapter delineates the procedures used to collect and analyze the data for this study. The time period covered, as well as the specific areas for cost comparison are presented. In addition, the cost categories deemed irrelevant for the purposes of this study are discussed.

The basics of this research entail a comparison of the intermediate maintenance (IMA) and Aviation Depot Level Repair (AVDLR) costs of three air wings over a twenty-one month period. The air wings used and their associated aircraft carriers are: Air Wing Five onboard the USS Independence (CV-62), Air Wing Eleven onboard the USS Lincoln (CVN-72), and Air Wing Fifteen onboard the USS Kitty Hawk (CV-63). Costs Per Flight Hour are calculated separately for deployed and non-deployed operations to assess the ability of the applicable accounting systems to capture costs. The cost data for Air Wing Five is compiled from USS Independence Budget OPTAR Reports (BOR). The cost data for Air Wings Eleven and Fifteen is from the aircraft carrier BORs, as well as solicited inputs from the applicable shore station comptrollers. Flight hour information for each of the squadrons was obtained from COMNAVAIRPAC records.

B. DATA SELECTION

The intention of this study is to define the factors that contribute most to the observed disparity of flight hour costs for the squadrons of Air Wing Five, forward deployed in Japan. To make the data comparable, the CONUS based squadrons used for comparison were screened on the basis of deployment schedules, air wing composition, and aircraft types.

1. Deployment Schedules

There are recognized cost differences between deployed squadrons and those in some stage of pre-deployment training. The additional costs of operating from the carrier deck are due in part to the harsh salt water environment and additional aircraft failures induced from catapult launches and arrested landings. In the opinion of the CNAP Force Comptroller, the costs incurred by Air Wing Five are nearly equal to the remaining air wings during periods of deployment. The assertion in this case is that the non-deployed cost difference is actually greater than the previously observed figure of 30%. [Ref. 8]

To compare the deployment costs, the squadrons selected for comparison must have completed one extended deployment during the time period of this study. For a comparison of non-deployed costs, the time period required must encompass at least an entire turn-around cycle. A period of twenty-one months was determined to be suitable for both of these

purposes. This interval also ensures the critical periods immediately prior to, and following deployment are included for all three air wings.

Costs were collected for the time period from October 1992 through June 1994. The air wings/carriers were deployed on the following dates during that period:

- CVW-5/CV-62 — 17 November 1993 - 17 March 1994
- CVW-11/CVN-72 — 15 June 1993 - 15 December 1993
- CVW-15/CV-63 — 03 November 1992 - 03 May 1993

It is important to note that the cruise for the CVW-5/CV-62 team was only four months in duration, as opposed to the standard six-month deployment. This is due to the reduced transit time for the USS Independence to operating areas in the Indian Ocean/Persian Gulf. The time spent "on station" in the Gulf was actually the same for all three carriers.

2. Air Wing Composition

All Navy air wings are not created equally. The number of squadrons and type of aircraft assigned varies depending on the specific air wing. This circumstance is normally due to the introduction of new aircraft into the fleet. Since the aircraft are purchased and produced over periods of many years, they are put into service in the same manner. It is not uncommon to have one or more squadrons transitioning to a new Type/Model/Series of aircraft during a turn-around.

Additionally, some recent top-level decisions concerning aircraft in the Navy inventory have contributed to this disparity in air wings. The reduction and retirement of the A-6 aircraft, along with a drastic reduction in the number of F-14 squadrons, have both served to produced a great deal of shuffling among air wings.

The current compositions of the three air wings are listed in Figure 2. The individual squadrons are listed for each air wing, along with the aircraft flown by that squadron. Although they are not identical, the differences are considered minor and do not affect the results of this study. To ensure this, not all of the squadrons listed below are used in the cost comparison. The following section lists the aircraft categories that were included, and highlights any reasons for exclusion.

AIR WING COMPOSITIONS

CVW-5		CVW-11		CVW-15	
USS *Independence*		**USS *Lincoln***		**USS *Kitty Hawk***	
VF-21	F-14A	VF-213	F-14A	VF-51	F-14A
VF-154	F-14A	VMFA-314	F/A-18A	VF-111	F-14A
VFA-192	F/A-18C	VFA-22	F/A-18C	VFA-27	F/A-18A
VFA-195	F/A-18C	VFA-94	F/A-18C	VFA-97	F/A-18A
VA-115	A-6E	VA-95	A-6E	VA-52	A-6E
VAQ-136	EA-6B	VAQ-135	EA-6B	VAQ-134	EA-6B
VS-21	S-3B	VS-29	S-3B	VS-37	S-3B
VAW-115	E-2C	VAW-117	E-2C	VAW-114	E-2C
HS-12	SH-3H	HS-6	H/SH-60F/H	HS-4	H/HS-60F/H

Figure 2. Air Wing Compositions as of 1 June 1994.

3. Aircraft Types

Cost information was collected from twenty-three separate squadrons for comparison purposes. Six different aircraft categories are represented by these squadrons. These aircraft Type/Model/Series are: F-14A, F/A-18C, A-6E, EA-6B, S-3B, and E-2C. Although squadrons VFA-27 and VFA-97 from CVW-15 fly the F/A-18A aircraft, these costs were considered reasonably similar for direct comparison with F/A-18C squadrons. However, cost information from the Marine F/A-18A squadron, VMFA-314, was not included due to the differences in the accounting and tracking systems employed by the Marine Corps.

Cost information from the helicopter squadrons (HS-12, HS-6, and HS-4) was also omitted from this comparison. HS-12 is one of the last Navy squadrons flying the SH-3H aircraft for carrier operations. Results from a direct comparison with squadrons flying the newer SH-60 series aircraft would be inconclusive at best.

From the data that was included, it was noted that CVW-11 has only one F-14A squadron. Until recently, the standard for Navy air wings has been two fighter squadrons. A top-level shift in emphasis from the F-14 to the F/A-18 aircraft has necessitated some marked changes in this area. VF-213 is the first F-14 "super" squadron, meaning the squadron has 16 aircraft instead of the usual 10 or 11. There are some unforeseen effects on the costs for this larger squadron that are highlighted in the last section of this chapter.

C. 7L AND 9S COSTS

The specific costs to be compared in this study are 7L and 9S costs. A more detailed description of cost categories is included in Chapter II of this thesis. Costs from the 7L funding code include both consumables and repairables, and the majority of these costs are incurred at the intermediate maintenance level. The 9S funding code is for Aviation Depot Level Repair (AVDLR), and these costs are for the high cost, or "big ticket" items that are beyond the capability of intermediate level repair. Aircraft engines are an example of a major contributor to this cost category.

The reason these cost categories were chosen are due to their low degree of direct correlation to the amount of flight hours flown by the subject squadron. Much of the expense generated in these categories over the long run can be viewed as the "fixed cost" of doing business. But, for shorter periods of time, such as one or two months, these costs are extremely variable. The twenty-one month period selected for use in this study is considered ample time to dampen much of the variability of these costs, thereby providing useful data for comparison.

D. OTHER COSTS

Costs incurred at the squadron level, along with miscellaneous costs, were excluded from this comparison.

Squadron level costs include a small portion of maintenance costs, mainly for consumables, and the cost of fuel for operating the aircraft. Although fuel costs account for approximately 36% of the total cost of operating Navy aircraft [Ref. 9, p. 47], these costs were not included in the data because of their high direct correlation to flight hours and squadron activity level. A previous study found the degree of variation caused by these costs to be on the magnitude of 2.4%, a relatively small portion of the total variation of approximately 30% [Ref. 10, p. 73]. By excluding these costs from the data, the true magnitude of the variations caused by the remaining 7L and 9S costs can be more accurately measured and analyzed.

Miscellaneous costs are the costs that are not directly attributable to an aircraft Type/Model/Series. They can be viewed as the indirect costs of doing business. An example of costs in this category would include the purchase and maintenance of ground support equipment, along with other equipment used for the common support of both local and transient aircraft. Because the miscellaneous costs are allocated based on a proportional share of direct costs, including them in this study would only serve to exaggerate the differences or variances from the 7L and 9S cost categories. In other words, the aircraft T/M/S with the largest share of traceable costs from each activity will also bear the largest burden or share of miscellaneous costs.

Although this may be an effective system for allocating miscellaneous costs, it would only cloud the issue and disguise the data in this study. The intention here is not to determine the total "true" cost of operating and maintaining Navy aircraft. Rather, it is merely to examine and analyze the cost variances that exist, and that can only be accomplished by using direct costs. It can be assumed that the difference between the cost variations generated from this study, and the previously observed variations of nearly 30%, are due largely to the distortion caused by the allocation of miscellaneous costs.

E. RESULTS OF COMPARISON

Tables 1-4 on the following pages provide the results of a direct comparison of the flight hours and subject costs for the aircraft in each of the three air wings. Hours and costs are further broken down into deployed and non-deployed time periods, along with the totals for each category. Table 1 is a comparison of the flight hours recorded for each aircraft type. Tables 2-4 provide a comparison of the direct 7L, 9S, and total 7L/9S costs per flight hour, respectively. The numbers in the shaded boxes represent the highest cost per flight hour observed for each operational category (deployed, non-deployed, total) and type of aircraft.

Some plausible explanations are available for the instances when the highest costs per flight hour were observed

FLIGHT HOURS

		Aircraft Type					
		F-14A	**F/A-18C**	**A-6E**	**EA-6B**	**S-3B**	**E-2C**
CVW-5 *USS Independence*	Deployed	3,335	3,800	2,303	832	1,241	1,072
	Non-deployed	8,894	9,715	5,717	2,311	3,884	2,664
	Total	12,229	13,515	8,020	3,143	5,125	3,736
CVW-11 *USS Lincoln*	Deployed	2,781	5,668	3,551	1,413	2,158	1,607
	Non-deployed	3,931	9,290	6,058	1,951	3,597	1,986
	Total	6,712	14,958	9,609	3,364	5,755	3,593
CVW-15 *USS Kitty Hawk*	Deployed	4,429	4,954	2,816	1,070	2,233	1,426
	Non-deployed	8,154	10,144	5,209	1,995	3,545	2,343
	Total	12,583	15,098	8,025	3,065	5,778	3,769

Table 1. Comparison of Flight Hours.

7L COSTS PER FLIGHT HOUR							
		Aircraft Type					
		F-14A	F/A-18C	A-6E	EA-6B	S-3B	E-2C
CVW-5 *USS Independence*	Deployed	$ 639.00	$ 306.18	$ 434.49	$ 921.10	$ 688.30	$ 480.46
	Non-deployed	$ 650.27	$ 272.62	$ 341.85	$ 707.10	$ 454.92	$ 569.40
	Total	$ 647.21	$ 282.06	$ 368.45	$ 763.75	$ 511.43	$ 543.88
CVW-11 *USS Lincoln*	Deployed	$ 735.13	$ 183.89	$ 282.64	$ 319.92	$ 312.44	$ 231.26
	Non-deployed	$ 800.01	$ 298.09	$ 195.37	$ 253.45	$ 544.68	$ 341.48
	Total	$ 773.13	$ 254.82	$ 227.62	$ 281.37	$ 457.60	$ 292.18
CVW-15 *USS Kitty Hawk*	Deployed	$ 175.03	$ 108.95	$ 132.96	$ 179.21	$ 79.37	$ 92.07
	Non-deployed	$ 690.50	$ 565.41	$ 290.72	$ 361.14	$ 478.50	$ 358.81
	Total	$ 509.06	$ 415.64	$ 235.36	$ 297.63	$ 324.25	$ 257.89

Table 2. Comparison of 7L Costs Per Flight Hour.

9S COSTS PER FLIGHT HOUR							
		Aircraft Type					
		F-14A	F/A-18C	A-6E	EA-6B	S-3B	E-2C
CVW-5 *USS Independence*	Deployed	$ 1,886.33	$ 1,186.50	$ 1,682.59	$ 2,515.86	$ 2,220.54	$ 1,423.07
	Non-deployed	$ 2,382.42	$ 1,322.54	$ 1,660.95	$ 2,498.92	$ 1,717.50	$ 1,634.26
	Total	$ 2,247.90	$ 1,284.29	$ 1,667.16	$ 2,503.41	$ 1,839.31	$ 1,573.66
CVW-11 *USS Lincoln*	Deployed	$ 1,715.39	$ 791.81	$ 1,012.43	$ 651.43	$ 1,177.45	$ 1,461.61
	Non-deployed	$ 1,843.00	$ 1,146.64	$ 454.29	$ 399.97	$ 1,142.15	$ 1,244.44
	Total	$ 1,790.13	$ 1,012.19	$ 660.55	$ 505.59	$ 1,155.38	$ 1,341.57
CVW-15 *USS Kitty Hawk*	Deployed	$ 359.54	$ 259.67	$ 438.41	$ 320.89	$ 208.35	$ 304.10
	Non-deployed	$ 1,637.25	$ 1,841.38	$ 950.40	$ 1,224.68	$ 1,353.27	$ 2,050.51
	Total	$ 1,187.52	$ 1,322.38	$ 770.74	$ 909.16	$ 910.80	$ 1,389.76

Table 3. Comparison of 9S Costs Per Flight Hour.

TOTAL 7L/9S COSTS PER FLIGHT HOUR							
		Aircraft Type					
		F-14A	F/A-18C	A-6E	EA-6B	S-3B	E-2C
CVW-5 *USS Independence*	Deployed	$ 2,525.33	$ 1,492.69	$ 2,117.08	$ 3,436.97	$ 2,908.84	$ 1,903.53
	Non-deployed	$ 3,032.68	$ 1,595.16	$ 2,002.79	$ 3,206.03	$ 2,172.42	$ 2,203.66
	Total	$ 2,895.11	$ 1,566.35	$ 2,035.61	$ 3,267.16	$ 2,350.74	$ 2,117.54
CVW-11 *USS Lincoln*	Deployed	$ 2,450.52	$ 975.70	$ 1,295.07	$ 971.35	$ 1,489.89	$ 1,692.87
	Non-deployed	$ 2,643.01	$ 1,444.73	$ 649.66	$ 653.41	$ 1,686.83	$ 1,585.92
	Total	$ 2,563.26	$ 1,267.00	$ 888.17	$ 786.96	$ 1,612.98	$ 1,633.76
CVW-15 *USS Kitty Hawk*	Deployed	$ 534.56	$ 368.62	$ 571.37	$ 500.10	$ 287.72	$ 396.17
	Non-deployed	$ 2,327.75	$ 2,406.79	$ 1,241.12	$ 1,585.82	$ 1,831.77	$ 2,409.32
	Total	$ 1,696.58	$ 1,738.02	$ 1,006.10	$ 1,206.79	$ 1,235.05	$ 1,647.64

Table 4. Comparison of Totals for 7L and 9S Costs Per Flight Hour.

in air wings other than CVW-5. In Table 2, the higher 7L costs for the F-14s of CVW-11 are directly attributable to the air wing composition. With only one, larger than normal F-14 squadron in CVW-11, the total hours flown by that squadron were just over 50% of the average total F-14 hours flown by the other two air wings. However, since VF-213 has 16 aircraft instead of the normal 10 or 11, the F-14 maintenance costs are closer to 75% of the normal air wing average. In the case of CVW-11, the F-14 costs per flight hour are driven higher by fact that costs and flight hours have not decreased by the same proportion. It is interesting to note that this condition occurs only with the 7L costs, and not with the 9S costs as well.

The consistently higher costs of the F/A-18A squadrons of CVW-15 are due to the employment of older model aircraft. The costs per flight hour are driven up considerably by the requirements to perform additional airframe modifications and capability upgrades. These procedures are often very expensive, and can take anywhere from a week to several months to complete. Virtually all procedures of this nature are conducted at squadron home stations, or at a Naval Aviation Depot (NADEP). This explains why these higher costs are observed only during the time periods when these squadrons are not deployed.

The explanations for higher costs per flight hour in S-3B and E-2C squadrons outside of CVW-5 are unknown. These could

possibly be a result of aircraft accidents resulting in substantial damage, or a higher than average number of engine replacements. Either of these occurrences would account for a dramatic increase in squadron costs, but data are not readily available to test these hypotheses.

IV. ANALYSIS OF RESULTS

A. GENERAL

In this chapter, the causal factors that contribute to the higher costs per flight hour in Japan-based squadrons are analyzed. The factors are presented in order of importance, based upon their contribution to the overall variance. The factors classified as "major" contributors include: logistics, operating tempo (OPTEMPO), carrier operations, and accounting system differences. Other contributing factors, of indeterminate magnitude, consist of squadron spending habits, access to training facilities, and personnel matters. This chapter concludes with an assessment of the consequences of consistently funding one air wing at a higher level than others.

B. ECONOMIES OF SCALE

The logistic complications of operating from a foreign shore play a major role in raising aircraft operating costs. The higher costs, when observed from the viewpoint of logistics, are a product of two related components. First, forward deployed squadrons do not enjoy the economies of scale inherent to squadrons based in the continental United States (CONUS). Being co-located with other squadrons of the same aircraft type, in addition to a large Fleet Replacement Squadron (FRS), provides the considerable benefits of sharing

supply lines and maintenance expertise. Along with this, the close proximity of fleet maintenance support facilities lend a comparative advantage in both time and expense.

The second component of this equation is the penalty that Japan-based squadrons must pay in shipping and handling costs. With the inception of the reimbursable Defense Business Operations Fund (DBOF) in DoD and the Navy, these added costs are more apparent to the consumer. Since the squadrons are ultimately the end-user for these parts and supplies, they must pick up the tab to ensure their continued availability.

C. OPTEMPO

The mission of Air Wing Five is unique because of its location and proximity to potentially hostile nations. These squadrons can ill afford lapses in readiness or combat capabilities. To guard against such occurrences, the squadrons of Air Wing Five must maintain a higher OPTEMPO than their counterparts stationed in CONUS.

These squadrons are by no means in peak fighting condition continuously. Attempting to maintain such a level of readiness would place undue strain on both people and equipment. But, in contrast to other squadrons, a higher minimum level of proficiency must be maintained throughout the entire turn-around cycle. Adhering to these higher standards of readiness demands a corresponding increase in OPTEMPO for the squadrons of Air Wing Five.

1. "Tip of the Spear" Mentality

One consequence of being forward deployed is carrying the banner as the United States first line of defense. To remain effective in this role, sailors and aviators develop what is referred to as a "tip of the spear" mentality. This is nothing more than the simple realization that, at any time and on very short notice, they can be called upon to enforce the policy or defend the interests of the United States abroad. This awareness injects a sense of urgency into routine decisions, especially those pertaining to readiness.

In terms of maintenance, there is increased pressure to maintain aircraft in a fully mission capable (FMC) status. To illustrate this point, consider an aircraft with a maintenance discrepancy on a particular weapons system. For a non-deployed squadron based in CONUS, this aircraft would still be available for use on the flight schedule to complete any training flight not requiring an operable weapons system. Maintenance to repair the weapons system could be deferred until it was convenient, without significantly impacting training.

Deployed squadrons, on the other hand, do not enjoy this flexible policy with respect to maintenance scheduling. To meet the more demanding nature of the mission, fully operable weapons systems are considered essential for flight under deployed conditions. The struggle to maintain FMC aircraft drives up maintenance costs for all squadrons during periods

of deployment. For the squadrons stationed in Japan, striving to maintain combat-ready aircraft is a full-time occupation.

2. Number of Aircraft Assigned

Modern military aircraft are a limited commodity due to the huge expense of technology. Their numbers have dwindled further in recent "downsizing" years, as more have been lost to accidents and obsolescence than were replaced. Forced to work with limited assets, it is not uncommon for squadrons to trade aircraft. In the F-14 community, a squadron returning from deployment and anticipating a "stand-down" period may transfer as many as half of its aircraft to other squadrons. These aircraft are replaced gradually during the turn-around cycle. Often, the squadron does not return to full strength until it is ready to deploy again. This arrangement results in a substantial cost savings for the squadrons that are not burdened with the expense of maintaining a full complement of aircraft.

Air Wing Five, by virtue of its isolation, does not normally participate in this aircraft swapping. They do participate in one-for-one trades on some occasions, usually initiated to facilitate the return of an aircraft to CONUS for specific maintenance needs. The net result of such an exchange has no effect on the overall number of aircraft in the squadrons of Air Wing Five. Maintaining a full complement of aircraft is essential for ensuring aircraft availability

and promoting combat readiness, but it does not come without additional costs.

D. CARRIER OPERATIONS

The most challenging environment for aircraft operations is from the deck of an aircraft carrier. It is equally demanding on both men and machines. The squadrons of Air Wing Five operate in the carrier environment more than any other Navy air wing. This fact is due not only to higher OPTEMPO and readiness requirements, but it is also a result of international agreements between the United States and Japan. One stipulation in the contract to permanently station an aircraft carrier in Japan places a limit on the consecutive days that the USS Independence may remain in port, with exceptions only for extenuating circumstances. Since the aircraft carrier alone has limited self-defense capability, the air wing must often accompany the ship to sea. In the previous chapter, the direct comparison of flight hour costs showed that maintenance costs are higher during periods of deployment. Some explanations for these increased costs are revealed by a closer examination of the factors at work in the carrier environment.

1. Catapult and Landing Induced Failures

The tremendous forces involved in launch and recovery evolutions aboard the carrier stress the aircraft to their

limits. Numerous maintenance failures are a direct result of flying in this regime. All of the aircraft components, especially the intricate and expensive avionics systems, are prone to damage induced by catapult launches and arrested landings. In addition, the useful life of consumable items, such as aircraft tires and arresting hooks, are extremely limited under these conditions.

2. Working Environment

Salt air and limited working space present additional hazards to aircraft operating in the carrier environment. The damaging effects of salt air and water are a constant concern for aircraft maintenance technicians. Additional maintenance costs are incurred through parts lost to salt intrusion, and in complying with extensive corrosion prevention programs.

Moving aircraft around on the flight deck and in the hangar bay is sometimes viewed as a complex ballet. However, even this evolution is not without occasional damage to one or more aircraft. The structural repairs required after such an incident can range from minimal to those that cause a complete loss of the aircraft. The incidence of foreign object damage (FOD) to aircraft engines is also much higher on the carrier flight deck. When ingested through an multi-million dollar aircraft engine, objects as small as a bolt or a piece of wire can cause irreparable damage.

E. ACCOUNTING SYSTEM DIFFERENCES

The Aviation Operations Maintenance (AOM) costs for air wings stationed in CONUS need to be assembled from various sources. These sources include both aircraft carriers and naval air stations. Although AOM costs are accounted for in a consistent manner by the aircraft carriers, the air bases accumulate and categorize costs in a manner consistent with the needs and desires of the individual stations [Ref. 6]. To complicate the matter further, costs must often be collected from bases other than the squadron home station to account for squadron detachments and other transient activities.

In contrast, the framework in place for capturing and reporting cost information for squadrons based in Japan is unique. The aircraft carrier USS Independence is the single collection point for all financial data pertaining to Air Wing Five aircraft. This arrangement is not only better for capturing direct costs, but also leads to a more accurate allocation of miscellaneous costs. Here, the costs of operating aircraft are not spread over several different ships and stations. As an added bonus, the probability of accounting errors is dramatically reduced by the simplicity of the system.

From this perspective, one can assert that a significant portion of the higher expenses reported by Japan-based squadrons are not additional costs at all. Rather, they

result from a more accurate reflection of the "true" costs of operating and maintaining Navy aircraft.

F. OTHER CONTRIBUTING FACTORS

Additional factors that drive up the costs of operating aircraft in Japan are difficult, if not impossible, to quantify. These factors are intangibles, related to differences in financial incentives, opportunities, and personnel. Although the contribution of these factors to overall cost variances may be relatively minor, they are presented here for completeness.

1. Incidence of "Learned Spending"

Money managers at the squadron level strive to spend 100% of their allotted funding. Any command that exceeds its funding level must petition up the chain of command for additional funds, if they exist. Squadrons rarely spend less than their allotted amount, fearing a corresponding reduction in funding for subsequent years. [Ref. 10, p. 2]

This "use it or lose it" mentality is by no means unique to the squadrons of Air Wing Five. There is no incentive in the current system for commands to cut costs. However, with respect to the squadrons in Japan, this phenomenon can be used to account for consistently higher spending rates. Since these squadrons have always been more expensive to operate, that higher level of spending has evolved into the norm. Any

reversal of this trend is perceived as sending the wrong signal to funding authorities, thereby jeopardizing future funding levels.

2. Training Facilities

The training opportunities in Japan differ markedly from those afforded in the United States. Distances and transit times to training ranges and alternate airfields are much greater. Air Wing Five squadrons must often travel as far as Okinawa to complete field carrier landing practice, a prerequisite for any carrier operations. Because of the distances involved, squadrons frequently participate in detachments away from their home station to complete routine training evolutions.

The lack of flight simulators for training purposes is also worthy of consideration. Several training requirements, such as annual NATOPS and instrument qualifications, must be conducted airborne. Although simulators are not a substitute for actual flight time, they are an effective complement in the areas of emergency procedures and refresher training [Ref. 10, p. 50]. Since this option is not available in Japan, additional flight time is necessary for aircrews to meet the same levels of proficiency.

3. Quality of Maintenance

The training opportunities and facilities for maintenance personnel, both at the squadron and intermediate maintenance

levels, are also extremely limited in Japan. In addition, living and working conditions in Japan may not be considered "ideal" by all Navy personnel. As a result, the Navy's brightest and most talented maintenance technicians are not drawn to duty in Japan. These same individuals, by virtue of their accomplishments, usually have greater influence in choosing duty assignments.

This is not meant to infer that maintenance personnel in Japan are not qualified or capable of completing all assigned tasks. It is merely an assertion that additional costs can be incurred when personnel are forced to learn "on the job". A significant portion of aircraft maintenance is diagnostic in nature, and higher levels of competence come only through experience.

G. FUNDING EFFECTS ON OTHER AIR WINGS

Budget dollars for the Navy Flying Hour Program are a scarce resource. When they are required by one element of the program, they are not available for other purposes. If Air Wing Five is funded at a higher level, money available for other air wings is reduced. The budgeteers at the type commander level have some leeway to move funds that have been earmarked for other purposes but, over the recent "lean" years, most of these resources have been tapped. An example is the current scarcity of administrative dollars for travel and temporary duty.

Probably the most dramatic effect of funding Air Wing Five at a consistently higher level occurred in the last quarter of fiscal year 1994. During a period of significant budget shortfall, COMNAVAIRPAC was forced to stand down several squadrons completely, for a span of several months. This was done so that forward deployed units, at various trouble spots throughout the world, could continue to fly. Standing down a squadron for such a period of time has several negative impacts, most notably on readiness and morale. As the squadron begins flying again, safety becomes a significant issue and cause for concern. [Ref. 7]

Funding Air Wing Five at a higher level forces the remaining air wings to disproportionately bear the burden of unexpected budget shortfalls. Instead of cutting back uniformly, other squadrons are subject to stand downs and reduced funding for at-home portions of their turn-around cycles.

V. CONCLUSIONS AND RECOMMENDATIONS

A. SUMMARY OF FINDINGS

There are four major factors that contribute to the higher costs per flight hour observed in Navy squadrons based in Japan. These factors are interrelated, and may be considered to be an unavoidable consequence of forward deployment. The major factors are a result of differences in the areas of:

1. Logistics and support
2. OPTEMPO
3. Frequency of carrier operations
4. Accounting treatment of flight hour costs

All aspects of operating expenses, including fuel, maintenance, and miscellaneous costs are affected by these differences. Taken as a group, these factors account for approximately 90% of the observed cost variances. The remaining 10% is relegated to a group of intangible factors. These can be categorized as differences in spending habits, training opportunities, and quality of maintenance personnel.

Consistently funding Air Wing Five at a higher level results in less money available for the remaining air wings. Therefore, additional funding to cover unexpected events or contingency operations must be drawn from other sources. Since it is not feasible to reduce funding for forward

deployed squadrons, both on the carrier and in Japan, CONUS squadrons suffer the brunt of funding reductions. This situation severely limits the options available to the budget officers at COMNAVAIRPAC. Drastic measures, such as standing down squadrons for excessive periods of time, can result from funding cutbacks or unexpected budget shortfalls.

B. SUGGESTIONS FOR FURTHER STUDY

A close analysis of the Navy Flying Hour Program uncovers numerous questions and areas of uncertainty. The focus of this thesis is on a narrow sector of the overall program: cost per flight hour determination. Thus, it provides a perspective on only a few of the problems and challenges associated with the financing and support of Naval Aviation. Additional research in the following areas could prove beneficial to the future managers of the Flying Hour Program:

- Is Cost Per Flight Hour (CPH) the most appropriate measure for use in planning and budgeting the resources of Naval Aviation? Fuel and other consumables are the only expenses that are closely tied to flight hours. Maintenance costs are prone to extreme fluctuations in the short-run. Are there other cost drivers that would be more accurate predictors of future costs?

- Should a standardized accounting system be developed for use by naval air station comptrollers to categorize AOM costs? COMNAVAIRPAC currently requires subordinate activities to account for funds grouped under the Type Equipment Codes (TECs) assigned to each aircraft Type/Model/Series (TMS). Additional codes for squadrons, or individual aircraft bureau numbers (BUNOs), could simplify the task of tracking squadron costs at the type commander level.

- Do the strategic benefits of stationing a carrier battle group in Japan outweigh the additional costs incurred? The decline in threat from the former Republics of the Soviet Union and other world events have significantly altered the threat environment since the first days the USS Midway was permanently assigned to Japan. In these days of downsizing and consolidation, would a cost/benefit analysis reveal that this arrangement is worthy of revisiting? While this arrangement is not based upon cost as other variables, political variables in particular, are relevant, cost may still be a significant consideration.

- How has the adoption of the Defense Business Operations Fund (DBOF) affected the operational costs of aviation units? The concept provides for support activities to achieve self-sufficiency by setting surcharge rates at a level to cover operating expenses. Initial feedback from customers of these DBOF activities indicates they are paying higher prices for the same parts and quality of service. Is there a plan to compensate the operational units for their loss of buying power, or at least acknowledge that this represents a reduction in funding?

C. CLOSING REMARKS

This thesis has addressed factors that affect flight hour costs in Navy tactical squadrons. The factors that contribute to the higher costs in Japan are considered an unavoidable consequence of operating in that particular threat environment. This would seem to merit a budget adjustment at the NAVCOMPT level, as no distinction between air wings currently exists at that level. However, since increased funding probably will not be forthcoming in the near future, managers of the Flying Hour Program need to investigate other avenues for increasing efficiency and/or reducing expenses.

Managers also need to know when to send up a distress signal. The best example to date was the COMNAVAIRPAC decision in FY94 to stand down several squadrons when the money ran out. The message was heard clearly up the chain of command that additional funding was necessary to conduct operations effectively and safely. In the opinion of the Force Comptroller at COMNAVAIRPAC, aviators are quite often their own worst enemy. By maintaining a "can do" attitude when funding is cut below safe and reasonable limits, they may ensure that the lower level of budget becomes the new standard for the Fleet and NAVCOMPT.

Therefore, managers must provide their cognizant budget authorities with a realistic assessment of the readiness and force levels that can be achieved by current funding levels. In these days of austere funding for defense programs, managers of the Navy Flying Hour Program must persevere in their efforts to maintain the high standards of Naval Aviation.

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